

The Role of the Infectious Disease Specialists in the Trauma Surgical Team

Ermira Muco¹, Amarildo Blloshmi¹, Engjellushe Jonuzi³, Agron Dogjani^{2,3*}

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Abstract

Introduction: Infection is a significant cause of posttraumatic morbidity and prolonged hospitalization. Nosocomial infections are a frequent complication of trauma patients admitted to the intensive care unit (ICU). Trauma is predisposed to infections by various mechanisms, while intravascular catheters, endotracheal tubes, and urinary catheters create suitable environments for nosocomial infection during treatment. Following trauma, wound contamination with aerobic and anaerobic bacteria should always be suspected.

Material and Methods: In this paper, we want to review the literature regarding the role of infectious disease (ID) specialists in the trauma team and compare it with the situation in our country.

Discussion: Infections in trauma are developed because of endogenous bacteremia or as a result of exogenous bacteremia. Since infection significantly prolongs the hospitalization of trauma patients, the infection disease specialist plays a crucial role in preventing and treating infections in collaboration with the surgeon and other trauma team members.

The duration of antibiotic treatment is significant. A shorter duration will result in fewer side effects and allergic reactions and reduce long-term antibiotic resistance.

Conclusions: The infectious disease specialist is not a standalone figure but an integral part of the trauma team. Their role is not limited to implementing protocols and using appropriate antibiotics before, during, and after surgical procedures. They also closely follow the patients, identifying those with a greater predisposition to develop infections. This collaborative approach is crucial for successfully preventing and managing infections in trauma patients.

Keywords: Infectious Disease Specialists, trauma, surgery.

Introduction

Infection is a significant cause of posttraumatic morbidity and prolonged hospitalization. Nosocomial infections are a frequent complication of trauma patients admitted to the ICU. [1]

Trauma is predisposed to infections by various mechanisms, while intravascular catheters, endotracheal

tubes, and urinary catheters create suitable environments for nosocomial infection during treatment. [2]

Following trauma, wound contamination with aerobic and anaerobic bacteria should always be suspected. [3]

Infectious disease (ID) specialists have played a significant role in patient care, infection control, and antibiotic management for many years. [4]

With the rapidly changing nature of health care, it has become necessary for ID specialists to articulate their value in trauma management as an integral part of trauma teams and not alone. [5]

Following trauma, wound contamination with aerobic and anaerobic bacteria should always be suspected. Treatment with antibiotics should begin immediately in the emergency room, particularly for those patients with open fractures. [6]

Patients with severe trauma are best treated by a team of specialists, including general surgeons, orthopedists, infectious disease specialists, and intensive care specialists. [7]

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* Corresponding author:

Prof. Dr. Agron Dogjani M.D., Ph.D., FACS, FISS, FICS,

✉ agrondogjani@yahoo.com

1 University Hospital Centre "Mother Theresa," Tirana, ALBANIA

2 Department of Surgery, Faculty of Medicine, University of Medicine, Tirana, ALBANIA

3 University Hospital of Trauma, Tirana, ALBANIA



It is known that penetrating abdominal trauma, such as stabbing or common gunshot wounds, constitutes the vast majority of traumatic emergencies that require surgical intervention.

Knives or other sharp tools carry a sizeable microbial load, and therefore, they favor the development of post-surgery infections. [8]

Also, the skin holds dirt, so destroying the skin barrier in these people increases the risk of septic conditions.[9] On the other hand, trauma induces increased production of proinflammatory mediators, damaging innate cellular immunity. Its damage makes the frequent presence of infections that bring multi-organ damage possible. [10]

Bacteremia is the critical point of septic conditions. Essential factors to prevent the development of bacteremia are immediate massive blood transfusion, placement of central venous catheters, endotracheal tube, perforation of the gastrointestinal tract, and liver and pelvic injuries. [11]

Hemorrhage accompanying intra-abdominal wounds is no less infectious.[12]

Predictors of sepsis are the presence of chronic diseases and the degree of damage in the patient. Mechanical ventilation and intravascular catheters lasting more than seven days increase the risk of subsequent bacteremia.[13]

Infections following urgent surgical interventions affect the skin and its layers, tissues, and muscles, as well as specific organs. When emergency surgical interventions involve cavities or organs such as the stomach, the risk of cavitary abscesses remains high. [14]

We can say that intra-abdominal infections accompany colon traumas after abdominal surgery. So, we will look after these interventions: wound infections, organ or intra-abdominal abscesses, necrotizing fasciitis, and diffuse suppurative peritonitis. [15]

The term “endogenous sepsis” is known by infectious disease specialists and equally well known by surgeons and anesthesiologists. [16]

Stoutenbeek C P showed the presence of endogenous sepsis in 81% of patients with multiple traumas in the intensive care unit who had not received antibiotic prophylaxis. This severe infection is developed from pathogenic bacteria in the oral cavity or intestines. [17]

So, the question naturally arises: Should we give antibiotics before surgery? Do we have to wait and see if the patient develops an infection as a complication and then treat it? [18]

Antibiotics, such as their type, dose, or duration of administration, have been controversial. Antibiotic prophylaxis has been used since the Korean War when wounded soldiers were given antibiotics while they were waiting to be transferred to the hospital. [19]

Routine laparotomy for penetrating abdominal injuries began in the 1800s, when Fleming discovered Penicillin in 1928; it enabled the first use of antibiotics in World War II to combat septic complications associated with trauma or wounds and reduce sepsis-related mortality and morbidity. [19]

Antibiotic prophylaxis in abdominal surgery is now standard clinical practice, and a single dose is sufficient to reduce post-surgical infections significantly. [20]

The antibiotic must be given in such a way as to reach an effective concentration in the tissue before the surgical intervention, which is before microbial contamination has yet occurred. [21]

We must consider a second dose when we face a surgical intervention that may last for a long time and we use an antibiotic with a short serum half-life. We translate this into a reduction in risk from 39% to 13% in postoperative infections.[20]

Fullen et al. Proved that patients treated with antibiotics before intervention developed an infection in 7% of cases compared to those treated with antibiotics during and after surgery, who created an infection in 33% and 30%, respectively. [9]

A unique or combined therapy that acts on both aerobes and anaerobes is more effective than an anaerobic or anti-anaerobic therapy alone. [20]

The infectious disease specialist chooses the right antibiotic that covers only those pathogenic microorganisms that can be related to the surgical procedure. Thus, in *Fowler's* article, he saw that when the advice of infectious disease specialists was followed, the probability of patients returning was much lower. [22]

The infectious disease specialist has better knowledge about antibiotics. He knows their great range and how to describe them according to type and dose. The infectious disease doctor calculates the duration of the treatment, thus protecting the patients from their allergic or toxic side effects and interactions with other medications given by the surgical team, as well as avoiding antibiotic resistance. [23]

Thus, he protects the patient by making the operation as safe as possible, but at the same time, protects the hospital and significantly reduces the cost-effectiveness of the treatment of a surgical patient. [24, 25]

This article summarizes the versatile attributes that ID specialists possess and defines their value to patients, hospitals, and other groups integral to the healthcare continuum as a closed circle.

The role of the infectious disease specialist cannot be overstated in the dynamic and demanding field of trauma surgery. As a vital member of the surgical trauma team, the infectious disease specialist provides invaluable support before, during, and after surgery, contributing to improved patient care and improved outcomes based on these pillars as follows;

Antibiotic Prophylaxis primarily aims to prevent surgical site infections (SSIs) by administering antibiotics before surgery. This helps reduce the risk of contamination and disease during the procedure.

Intraoperative Antibiotics: Aim to maintain adequate levels of antibiotics in the patient's bloodstream and tissues during surgery. This continuous exposure helps prevent bacterial colonization and infection at the surgical site.

The trauma team should know how to administer the “right” antibiotic to the “right” patient at the “right” time, at the “right” dosage, and for the “right” duration. However, high rates of inappropriate Surgical antibiotic prophylaxis (SAP) are standard across the surgical pathway. [26]

Postoperative Antibiotics are used selectively to manage specific risks of infection following surgery. The objective is to address ongoing risks or complications that may increase the likelihood of infection after the operation. [27]

Reducing the Risk of Post-surgical Infections with Antibiotic Prophylaxis significantly reduces the risk of post-surgical infections, including SSIs. By targeting potential pathogens before they can cause infection, prophylactic antibiotics play a crucial role in improving patient outcomes and reducing healthcare-associated infections. [28]

Consideration of Antibiotic Spectrum Against Aerobic and Anaerobic Microorganisms: When selecting antibiotics for prevention, it is essential to consider the spectrum of antibiotic activity against aerobic (oxygen-requiring) and anaerobic (non-oxygen-requiring) microorganisms. This consideration ensures adequate coverage against various potential pathogens encountered during surgical procedures. [29]

Naturally, these questions are raised: Should antibiotics be used as prevention? Should intraoperative antibiotics be used? Should postoperative antibiotics be used? Does Antibiotrophylaxis reduce the risk of post-surgical infection? Should the spectrum of their action against aerobic and anaerobic microorganisms be considered? [27]

Discussion

Thomas Sydenham (1629–1689), the “English Hippocrates,” showed that the manifestations of a fever represented nature’s efforts to eliminate the harmful agents that cause the disease. [30]

Tools that cause damage, such as knives, other sharp tools, shells, and various elements, such as bleeding, the presence of central venous catheters and endotracheal tubes, or blood transfusion itself, cause bacteremia. The patient manifests fever, temperature, and a genuine clinical sepsis related to bacteremia. Infections are the ones that greatly complicate the work of the surgeon when they appear in traumatized patients. [31]

These infections develop because of endogenous bacteremia (when the intestinal tract is damaged) and exogenous bacteremia (from restoratives). Open pelvic fractures are severe traumas that require complex therapy and multidisciplinary follow-up to prevent complications such as hemorrhage or sepsis in time. Multiple authors have demonstrated the impact of infectious disease specialists in reducing antibiotic costs while optimizing patient outcomes in treating trauma-related infections. [32, 33]

The absolute importance of surgeons, anesthetists, and ward nurses in the great work with traumatized patients is known. However, we can also say that depending on the

duration and nature of the surgical procedure, the immunity of the patients, or their predisposition to infections, the presence of an infectious diseases specialist assumes even greater value than the trauma team itself. [11]

The infectious disease specialist prepares a well-thought-out diagnostic and therapeutic plan, making the patient’s clinic as easy as possible. Thus, in one of their studies, *Tiffany* and his colleagues showed that the infection had increased patients’ length of stay in the hospital by 34.1 versus 7.0 days and in the intensive care unit by 21.8 versus 4.7 days. [34]

The bacteremia these patients develop leads to infections and then very quickly to a septic state. Microorganisms causing bacteria in these patients are numerous. *Hak-Jae* and others put the most excellent isolation on gram-positive organisms. [35]

They are the most common causes of early bacteremia in patients with clean operations. A complex of gram-positive and gram-negative microorganisms live in gastrointestinal or genitourinary tract procedures. Gram-negative bacteria are the cause of complications such as acute peritonitis or sepsis, while anaerobic bacteria such as *Bacteroides fragilis* are the cause of intra-abdominal abscesses. [36]

When penetrating abdominal traumas involve the colorectal tract, antibiotic prophylaxis against aerobic and anaerobic bacteria dramatically reduces the risk of wound infection. Some authors talk about a reduction of up to 75%. [20]

In 2017, the Global Alliance for Infections in Surgery shared with over 230 experts from 83 different countries a global statement on the appropriate use of antimicrobial agents in hospitals worldwide. They describe the basic principles of prevention and proper antibiotic therapy along the surgical route. [124] When antibiotics are given as a precaution, providing them during or after surgery may not be necessary. This fact is supported by other authors, arguing that avoiding the range of resistant microorganisms and the occurrence of colon inflammation from *C. Difficile* is essential. [20]

The duration of antibiotic treatment is significant. With a shorter duration, we will have fewer side effects, fewer allergic reactions, and reduced antibiotic resistance. With a shorter duration, we create costs that are as acceptable as possible for the institution, helping the latter sufficiently. Until now, we associate sepsis with objects that cause penetrating trauma or with a series of other elements. However, care should be taken first by the health personnel themselves as they can become the cause of bacteria. In a book by the surgeon *Sherwin B. Nuland* on the history of *Ignaz Philipp Semmelweis*, the author refers to puerperal fever as the “doctors’ plague” because these same doctors and medical students who treated the patients spread the infection by their hands. [23]

Semmelweis, once treated as an outcast, is now known as the “father of infection control.” However, we are now in the time of a significant modernization of medicine, specifically of surgery and the techniques used there. All

this dramatically helps in sepsis, and sometimes, antibiotics are questioned. However, until then, the infectious disease specialist remains an excellent operation manager, before and after, monitoring the patients step by step, especially those with a high risk of infection.[36]

Conclusions

It is better to prevent than to treat the infections associated with traumatic surgery. We are in the time of prevention and management of surgical infections. Even in our country, during these last 20 years, the management of trauma in surgical emergencies has progressed. The surgeon and the infectious disease specialist make an excellent team to discuss antibiotics, how to use them, and the microbial flora you must cover. The specialist of contagious diseases improves the protocols of infectious pathologies related to surgical procedures.

The infectious disease specialist helps implement these protocols by using appropriate antibiotics before, during, and after surgical procedures. He also closely follows the patients, identifying those with a greater predisposition to develop infections.

Applying these protocols during surgical procedures is necessary not only for preserving the institution's image and reducing costs but also for the safety and well-being of the patient. The institution must educate and train surgeons in preventing and managing infections in cooperation with infectious disease specialists.

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